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ART. XVIII.—*Victorian and South Australian Shallow-Water Foraminifera. Part II.*

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(With Plates XXI. and XXII., and one text-figure.)

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Introduction.

This is the second and concluding part of a paper dealing with new and interesting foraminifera found during the examination of a number of shore sands and shallow-water dredgings from the coasts of Victoria and South Australia. Details of the material studied will be found in Part I. Since Part I. was written, further samples from the same stations have been examined, with the result that additional species have been discovered and are included here. The following species and variety are described as new:—

<i>Gaudryina hastata</i>	<i>Discorbis collinsi</i>
<i>Vaginulina vertebralis</i>	<i>Discorbis vesicularis</i> (Lam.), var. <i>aceroulinoides</i> .
<i>Bolivinella elegans</i>	<i>Anomalina nonionoides</i> .
<i>Reussia armata</i>	
<i>Discorbis australis</i>	

Systematic Description of Species.

Order FORAMINIFERA.

Family SACCAMINIDAE.

Sub-Family SACCAMMININAE.

Genus **Proteonina** Williamson, 1858.

PROTEONINA SPICULIFERA Parr.

(Plate XXII., Fig. 39.)

Proteonina spiculifera Parr, 1932, *Proc. Roy. Soc. Vic.*, xliv. (n.s.)
(1) (for 1931), p. 2, pl. i., fig. 1.

A figure of a broad example, also from the type locality for this species, viz., Point Lonsdale, is here given.

Family VERNEUILINIDAE.

Genus **Gaudryina** d'Orbigny, 1839.

GAUDRYINA HASTATA, sp. nov.

(Plate XXII., Figs. 40a, b.)

Description.—Test elongate, tapering, the triserial portion trihedral, with sharp angles and concave faces; biserial portion broadly ovate to sub-quadrate in end view; apertural end truncate; chambers numerous, distinct, later ones slightly inflated; sutures distinct; wall arenaceous, fairly smoothly finished; aperture arched, at the base of the inner margin of the last-formed chamber.

Length up to 1.2 mm.

Holotype (Parr Coll.) from shore sand, Port Fairy, Vic., collected by F. Chapman.

Remarks.—Several specimens, all megalospheric, were found in the material from Port Fairy. The species is common in dredgings from a depth of about 100 fms., off the coast of New South Wales, in Bass Strait, and in the Great Australian Bight. In these, examples of both megalospheric and microspheric stages are present. In adult specimens of the megalospheric form, the triserial portion of the test consists of about eighteen chambers, and forms about one-quarter of the shell. There are usually about fourteen chambers in the biserial portion. The microspheric form is of similar length, but has a much longer, more sharply-angled triserial portion, the chambers numbering as many as 39. There are seldom more than six or eight in the biserial portion.

Several other species of the same general type have been recorded from the Pacific, namely *G. rugosa* d'Orb., *G. triangularis* Cushman, *G. convexa* Cushman, and *G. quadrangularis* Bagg. The last-named is perhaps the nearest to the present species, but has a much larger, rougher test, with blunt angles and fewer chambers. In one dredging from 30 miles south of Cape Nelson, Vic., 300 fms., *G. hastata* is associated with the species figured by Brady in the *Challenger* Report as *G. rugosa*. The latter is easily distinguished from the former by its different shape, fewer chambers, rough finish, and colour. Heron-Allen and Earland (1922, *Brit. Ant. ("Terra Nova") Exped., 1910, Foram.*, p. 122, pl. iv., figs. 16, 17) have figured as *G. rugosa* what appears to be the microspheric form of the present species. The specimens were from off New Zealand, where they occurred in company with "short, comparatively few-chambered individuals." It would be interesting to know if the two forms can be separated in the same way as those from south of Cape Nelson.

Family MILIOLIDAE.

Genus **Spiroloculina** d'Orbigny, 1826.

SPIROLOCULINA sp. aff. ARENARIA Brady.

(Plate XXII., Figs. 41a, b.)

Stn. 2.

There are several examples of an arenaceous species of *Spiroloculina* in the shallow-water dredging from Westernport Bay. It seems distinct from any known form of the genus, but, as so little material is available, it is here recorded under the name of the species which it most closely resembles, viz., *S. arenaria* Brady, also from the Pacific. The present form has a more compressed test, with a larger aperture than Brady's species, and the chambers are more distinct. The apertural tooth also separates it from *S. arenaria*.

Genus **Triloculina** d'Orbigny, 1826.

TRILOCULINA LABIOSA d'Orbigny.

(Plate XXII., Fig. 44.)

Triloculina labiosa d'Orbigny, in De La Sagra, *Hist. Fis. Pol. Nat. Cuba*, "Foram.," p. 178, pl. x., figs. 12-14.

Miliolina labiosa (d'Orb.): Chapman, 1909, *Jour. Quek. Micr. Club*, [2], x (for 1907), p. 122, pl. ix., fig. 2.

Triloculina labiosa d'Orb.: Cushman, 1922, *Publ.* 311, *Carn. Inst. Wash.*, p. 77, pl. xii., fig. 1.

Stns. 1, 6, 8, 9, 10, 11. C., H.

Common. This species was described from the West Indies, and is widely distributed in the Indo-Pacific region. In the present gatherings, it was common at Point Lonsdale, where, in addition to the typical form, many examples of a wild-growing variety were found. These bear a superficial resemblance to *Parrina bradyi* (Millett), in which, however, the early chambers are similar to those of the genus *Calcituba*, and are not arranged on a triloculine plan. They are recorded below as *T. labiosa*, var. *schauinslandi* (Rhumbler).

TRILOCULINA LABIOSA d'Orbigny, var. SCHAUINSLANDI
(Rhumbler).

(Plate XXII., Fig. 43.)

Miliolina schauinslandi Rhumbler, 1906, *Zool. Jahrb., Abteil. Sys.*, xxiv., p. 41, pl. iii., figs. 20, 21.

Quinqueloculina (?) *schauinslandi* (Rhumbler): Cushman, 1917, *Bull.* 71, *U.S. Nat. Mus.*, pt. 6, p. 56, pl. viii., figs. 7, 8 (after Rhumbler).

Nubecularia schauinslandi (Rhumbler): Heron-Allen and Earland, 1924, *Journ. Linn. Soc. (London) Zool.*, xxxv., p. 601, pl. xxxv., figs. 2-5.

Stn. 6.

The best-developed specimens answer perfectly to the description, given by Heron-Allen and Earland, of their Lord Howe Island examples. The early portion of the test is similar to *T. labiosa*, and is followed by a straight or curved series of irregularly-formed chambers, terminating in a large, gaping, irregular aperture into which a number of teeth-like processes project. Less-developed specimens similar to that here figured agree with a form recorded by several authors as *Nubecularia bradyi* Millett. Rhumbler's type-specimens were from shore sand of Laysan Island.

Family LAGENIDAE.

Sub-Family NODOSARIINAE.

Genus **Vaginulina** d'Orbigny, 1826.

VAGINULINA PATENS Brady.

Vaginulina patens Brady, 1884, "Chall." Rept. Zool., vol. ix., p. 533, pl. lxvii., figs. 15, 16.

V. costata Chapman (non *Planularia costata* Cornuel), 1909, Jour. Quek. Micr. Club [2], x (for 1907), p. 130, pl. ix., fig. 10.
Sidebottom, 1918, J.R.M.S., p. 139, pl. v., figs. 4, 5.

Stn. 4.

One small example. The records of this species are all from the Pacific. It has been confused with *Planularia costata* Cornuel described (1848, *Mém. Soc. Géol. France* [2], iii., *Mém.* 3, p. 253, pl. ii., figs. 5-8), from the Cretaceous of France, which is a very different form, as the study of Cornuel's description and figures will show.

VAGINULINA VERTEBRALIS, sp. nov.

(Plate XXII., Fig. 42.)

Description.—Test clongate, slightly curved, consisting of up to eleven chambers. The proloculum is about twice as long as the chambers immediately succeeding it, and bears a short blunt spine. The first three chambers have usually six fairly strong costae, the remainder being smooth; the later chambers are set on obliquely, strongly inflated ventrally, and taper dorsally into a stout keel. The sutures are distinct, and are carried into the keel as bands of clear shell substance, hence the specific name. Aperture produced, radiate.

Length up to 2.2 mm.

Holotype (Parr Coll.) from shore sand, Torquay, Vic., collected by A. C. Collins.

Remarks.—This species is rare, but is also found in the Post-tertiary of Victoria, at Boneo, and occurs in the Lower Pliocene beds at Beaumaris. It is very constant in its characters. It is closely related to two species, figured by Soldani and named *Nodosaria (Dentalina) arcuata* and *N. (D.) carinata* by d'Orbigny (*vide* Parker, Jones, and Brady, *Ann. Mag. Nat. Hist.* [4], viii., 1871, p. 159, pl. ix., figs. 49, 50, where Soldani's figures are reproduced). These were from the Mediterranean Sea.

Genus **Frondicularia** DeFrance, 1824.

FRONDICULARIA ADVENA Cushman.

(Plate XXII., Fig. 47.)

Frondicularia inaequalis Brady (*non* Costa), 1884, "*Chall.*" *Rept. Zool.*, vol. ix., p. 521, pl. lxvi., figs. 8-12. Flint, 1899, *Rept. U.S. Nat. Mus.*, for 1897, p. 313, pl. lix., fig. 2.

F. advena Cushman, 1923, *Bull.* 104, *U.S. Nat. Mus.*, pt. 4, p. 141, pl. xx., figs. 1, 2.

Stn. 4.

There is one small example in which the four chambers following the proloculum are arranged biserially. Brady's Fig. 11 and the left-hand specimen in Flint's figures exhibit a similar arrangement of the early chambers, which is also found in many of the fossil examples at hand from the Oligocene (Balcombian) of Victoria and the Miocene of Trinidad. Apparently the genus *Frondicularia* includes species derived from the recently-described genus *Kyphopyra* Cushman.

F. advena, according to Cushman, is common in the Western Atlantic and in the Pacific. Brady's figured examples were from off the Ki Islands. It is also found in the Older Tertiary of Victoria. This species may prove to be identical with Stache's *F. whaingaroica*, a fossil species from New Zealand, which has not been recorded since it was described by Stache in the *Novara* Expedition Reports.

Family PENEROPLIDAE.

Genus **Spirolina** Lamarck, 1804.

SPIROLINA ACICULARIS (Batsch).

(Plate XXII., Figs. 45a, b; 46a, b.)

Nautilus (Lituus) acicularis Batsch, 1791, *Conch. Seesandes*, p. 4, pl. vi., figs. 16a, b.

Spirolina acicularis (Batsch): Cushman, 1930, *Bull.* 104, *U.S. Nat. Mus.*, pt. 7, p. 42, pl. xv., figs. 1-3.

Stns. 9, 11, and Minlacowie, Sth. Aust.

This species occurs in two forms at each locality. The commoner is thin-shelled and the ornament consists of lines of very

small tubercles. The other has a thicker shell-wall and its surface is smooth. In outline both agree with the broader specimen figured by Dr. Cushman from the Tortugas. The original figures given by Batsch represent a much slenderer form, examples of which I have from Jeddah, on the Red Sea.

Parker and Jones recorded *Spirolina lituus* from coast sand, Melbourne, Australia. The present species was probably that met with. It may also be noted that the present records are all from the coast of South Australia, and provide additional evidence that the locality given by Parker and Jones was incorrect.

Family HETEROHELICIDAE.

Sub-Family BOLIVINITINAE.

Genus **Bolivinella** Cushman, 1927.

BOLIVINELLA FOLIUM (Parker and Jones).

(Plate XXI., Fig. 23.)

Textularia folium Parker and Jones, 1865, *Phil. Trans. Roy. Soc.*, clv., pp. 370, 420, pl. xviii., fig. 19. Brady, 1884 (*pars*), "Chall." *Rept. Zool.*, vol. ix., p. 357, pl. xlii., figs. 1, 2 (*non* figs. 3-5). Chapman, 1909, *Jour. Quek. Micr. Club*, [2], x (for 1907), p. 127, pl. ix., fig. 4.

Bolivinella folium (P. and J.): Cushman, 1927, *Contr. Cushman. Lab. Foram. Res.*, ii. (4), p. 79. 1928, *Cushman. Lab. Spl. Publ. No. 1*, pl. xxxiii., figs. 15, 16 (*non* pl. xxxiv., fig. 8). 1929 (*pars*), *Contr. Cushman. Lab.*, v. (2), p. 29 (*non* pl. v., figs. 1, 2).

B. folia (P. and J.), var. *ornata* Cushman, 1929, *op. cit.*, p. 32, pl. v., figs. 3, 4.

Stns. 6, 7, 9, 11. P. and J., C.

Two species appear to have been recorded under this name, the confusion having arisen, in the first place, through the rather poor type-figure, and later, as the result of Brady's wide interpretation of specific differences. From the study of specimens from the type area, one can state fairly definitely that the form named by Dr. Cushman *B. folia*, var. *ornata*, from Hardwicke Bay, South Australia, and the Post-tertiary of Victoria, is actually *B. folium* (*typica*). The other (Brady, 1884, *op. cit. supra*, pl. xlii., figs. 3, 3b, 4, 5. Cushman, 1928, *op. cit.*, pl. xxxiv., fig. 8; 1929, *op. cit.*, pl. v., figs. 1, 2) is a tropical species, which is distinguished from *B. folium* by its fewer, proportionately-higher chambers, the less-convex apertural end, the absence of beading on the sutures, and by the usually more-flaring test.

It may be known as *B. elegans*, sp. nov., the holotype being from off Raine Island, 155 fms. This species does not occur in Bass Strait, nor off the south-eastern coast of Australia, but I have fine examples of it from *Challenger* Stn. 185, off Raine Island, Torres Strait, 155 fms. Well-preserved examples of *B. folium* are invariably beaded on the suture lines, the beads being formed by the cutting of the limbate sutures by longitudinal striae, such as are represented in Mr. Chapman's figure of an example of this species, from the shore sands of McHaffie's Reef, Phillip Island. The specimen here figured is worn, but the characteristic beading is present. It was drawn before the beautifully-preserved material from Hardwicke Bay, South Australia, some of which have been illustrated by Dr. Cushman, was obtained. In the recent condition, the species is usually rare. It is not uncommon in the Post-tertiary of the Vic. Geol. Survey Bore No. 5, at Bonco, near Rosebud, between 177 and 187 feet.

Family BULIMINIDAE.

Sub-Family REUSSIINAE.

Genus **Reussia** Schwager, 1877.

REUSSIA ARMATA, sp. nov.

(Plate XXII., Figs. 49, 50a, b.)

Description.—Test in the adult rhombohedral, with the initial end armed with a short spine, apertural end rounded, the sides slightly concave, margin sharp and with one or two spines on each of the outer angles; chambers arranged in three series, with about twelve in each, increasing in height as added, wider than high; sutures distinct, flush, slightly curved; wall calcareous, smooth, of medium thickness, finely perforate; aperture a curved slit at the base of the inner edge of the last-formed chamber; colour white.

Length up to 0.77 mm.

Holotype (Parr Coll.) from shore sand, Hardwicke Bay, South Australia.

Remarks.—The shape of this species will enable it to be distinguished from *R. spinulosa* (Reuss), to which it otherwise bears some resemblance. The larger number of chambers, their comparative lowness, and the very neat test are also characteristic. *R. armata* is common at Hardwicke Bay, and many double specimens similar to those here figured were met with in the material from that locality. Other examples of the species are from Stns. 6, 7, and 9. The two Victorian specimens, from Stns. 6 and 7, are small and much worn.

Sub-Family UVIGERININAE.

Genus **Siphogenerina** Schlumberger, 1883.

SIPHOGENERINA RAPHANUS (Parker and Jones).

(Plate XXI., Fig. 24.)

Uvigerina (Sagrina) raphanus Parker and Jones, 1865, *Phil. Trans.*, clv., p. 364, pl. xviii., figs. 16, 17.*Sagrina raphanus* (P. and J.): Brady, 1884, "Chall." *Rept. Zool.*, vol. ix., p. 585, pl. lxxv., figs. 21-24.*Siphogenerina raphanus* (P. and J.): Cushman, 1926, *Proc. U.S. Nat. Mus.*, lxxvii., Art. 25, p. 4, pl. i., figs. 1-4; pl. ii., figs. 1-3, 10; pl. v., figs. 1, 2.

Stns. 6, 7, 8.

There are four small, but otherwise typical specimens, all from the Victorian coast. This appears to be the most southerly record for this species.

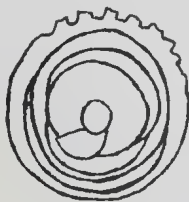
Family ROTALIIDAE.

Sub-Family DISCORBISINAE.

Genus. **Annulopatellina** Parr and Collins, 1930.

ANNULOPATELLINA ANNULARIS (Parker and Jones).

(Plate XXII., Figs. 48a-c; Text-fig. 1.)

Orbitolina annularis Parker and Jones, 1860, *Ann. Mag. Nat. Hist.*, [3], vi., pp. 30, 31.*Annulopatellina annularis* (P. and J.): Parr and Collins, 1930, *Proc. Roy. Soc. Vic.*, xliii. (n.s.), (1), p. 93, pl. iv., figs. 8-10. (Gives complete references.)Stns. 6, 7, 9, 11. P. and J., C. (as *Patellina corrugata* Will.)*Annulopatellina annularis*

(Parker and Jones).

Apex of microspheric example showing semi-annular chambers. Hardwicke Bay, S.A. Greatly magnified.

Text-figure 1.

Common at Stn. 11 and frequent at Stn. 9; one example from each of the Victorian stations. Because of our inexperience in the more refined methods of examining the finer structures of these minute shells, Mr. Collins and I were unable to see any definite relationship of this genus with *Patellina*. Our friend,

Dr. J. A. Cushman, has pointed out to us that if specimens are mounted in glycerine and examined under a high power, several semi-annular chambers can be seen following the first two chambers. He is also sure that he has found, in the later development, chambers which are not completely annular. I have mounted both megalospheric and microspheric forms in glycerine, and find that the relationship to *Patellina* is evident in the microspheric form, but I have not so far observed any semi-annular chambers in the megalospheric form, although Dr. Cushman's camera lucida drawings show that he had them in this. A drawing of the early chambers of a microspheric specimen is figured in the text (text-fig. 1).

Genus **Discorbis** Lamarck, 1804.

DISCORBIS WILLIAMSONI Chapman and Parr MS.

(Plate XXI., Fig. 25.)

Rotalina nitida Williamson (*non Rotalina nitida* Reuss), 1858, *Rec. Foram. Gt. Britain*, p. 54, pl. iv., figs. 106-108.

Discorbina nitida (Will.): Sidebottom, 1908, *Mcm. Proc. Manch. Lit. Phil. Soc.*, lii., No. 13, p. 13, pl. iv., figs. 6a-c.

Stns. 3, 7, 9.

There are five specimens agreeing exactly with Sidebottom's figure of an example from the Eastern Mediterranean. As Reuss (1844, *Geogn. Skizze Böhmen*, vol. ii., pt. 1, p. 214) had previously used the name of *Rotalina nitida* for another species, Williamson's species will be renamed by Mr. Chapman and the writer in a monograph on the foraminifera, dredged by the Australasian Antarctic Expedition 1911-1914, which is awaiting publication.

DISCORBIS MARGARITIFERA (Heron-Allen and Earland).

(Plate XXI., Figs. 26a-c.)

Discorbina margaritifera Heron-Allen and Earland, 1924, *J.R.M.S.*, p. 167, pl. xi., figs. 71-73.

Stn. 6.

Several typical examples. This is the first record of this species in the Recent condition. The only other record is that of Heron-Allen and Earland from the Miocene of Batesford, Vic. I have it also from the Lower Beds at Muddy Creek (Oligocene), the marl beds at Rocky Point, Torquay (Miocene), and a boring near Bonco, Vic., 177-187 feet (Post-tertiary).

DISCORBIS AUSTRALIS, sp. nov.

(Plate XXII., Figs. 31a-c.)

Discorbina valvulata Brady (non *Rosalina valvulata* d'Orbigny), 1884, "Chall." Rept. Zool., vol. ix., p. 644, pl. lxxxvii., figs. 5-7. Howchin, 1890, *Trans. Roy. Soc. Sth. Aust.*, xiii., p. 167. Chapman, 1909, *Jour. Quek. Micr. Club*, [2], x (for 1907), p. 137.

Description.—Test nearly circular in outline, plano-convex, ventral side slightly concave, trochoid, consisting of about three whorls; with four or five chambers in the last-formed coil, chambers slightly inflated; sutures strongly recurved, thick, and heavily limbate; wall calcareous, thick, coarsely perforate on the convex side, smooth underneath; aperture an arched slit at the base of the last-formed chamber, opening into the umbilical region; colour light brown in the early portion of the test, becoming paler towards the final chambers and colourless on the inferior side.

Diameter, 0.66 mm.; height, 0.43 mm.

Holotype (Parr Coll.) from shore sand, San Remo, Vic. (Stn. 1); other examples from Stns. 2, 6, 7, 8, 9, 10, 11.

Remarks.—Dr. Cushman (1921, *Proc. U.S. Nat. Mus.*, lix., p. 59) has already pointed out that the species figured by Brady in the *Challenger* Report as *Discorbina valvulata* is entirely different from d'Orbigny's *Rosalina valvulata*, from the West Indies. In its typical form, *D. valvulata* is much compressed, very thin-shelled and translucent, and very finely perforate, while the specimens figured under this name by Brady have a much heavier, thicker test, with coarse punctations, different shape, and thickened limbate sutures. Brady's figs. 5 and 7 were drawn from Pacific specimens, fig. 5 being from off East Moncoeur Island, Bass Strait, 38 fms., and fig. 7 from off Fiji. This form is common in shallow water on the southern coast of Australia, and occurs as a fossil in the Oligocene of Muddy Creek, Vic. There is remarkably little variation in the species over this area.

DISCORBIS VESICULARIS (Lamarck), var. DIMIDIATA (Jones and Parker).

(Plate XXI., Figs. 27a-c, 28a-c, 29a-c.)

Discorbina dimidiata Jones and Parker, in Carpenter, Parker and Jones, 1862, *Intro. Foram.*, p. 201, text-fig. 32b.

D. vesicularis (Lamarck): Carpenter, Parker and Jones (*pars*), 1862, *op. cit.*, p. 204, pl. xiii., figs. 2, 3.

D. dimidiata J. and P.; Parker and Jones, 1865, *Phil. Trans.*, clv., pp. 385, 422, 438, pl. xix., figs. 9a-c.

D. vesicularis Parker and Jones (non *Discorbites vesicularis* Lamarck), 1865, *op. cit.*, p. 438. Brady, 1884, "Chall." *Rept. Zool.*, vol. ix., p. 651, pl. lxxxvii., fig. 2. Chapman, 1909, *Journ. Quek. Micr. Club*, [2], x (for 1907), p. 135.

D. dimidiata J. and P.: Chapman, 1909, *op. cit.*, p. 136, pl. x., figs. 8a, b. Stns. 1, 2, 5, 6, 7, 8, 9, 10, 11. P. and J., C., H.

D. dimidiata was described by Parker and Jones as merely *D. vesicularis*, modified by being sharp-edged and flat, even scooped on the under surface, and with the astral flaps strongly marked over the umbilicus. Their figures show a shell with the coils almost completely involute on the superior face, the central portion of which is depressed, about nine chambers in the last whorl, much depressed sutures, and a flat inferior face. The aperture, which is abnormal, is figured as a slightly curved, fairly broad, elongate slit, nearly parallel to the plane of coiling. This particular form is not widely distributed, and, in my material, occurred only at Stn. 9, Glenelg, South Australia, where it was common. At the same locality, there are numerous examples of the form figured by Carpenter, Parker and Jones, and later by Brady, as *Discorbina vesicularis*. This has strongly inflated chambers and a more or less rounded margin. In the writer's experience, neither form occurs north of the latitude of Sydney, nor on the coast of Victoria and New South Wales, where they are replaced by intermediate specimens of weaker growth, with an evolute test. As similar annectant forms are found at Glenelg with the first two forms mentioned, it is clear that the latter are merely the result of exceptionally favorable conditions of growth. It appears likely that the *D. dimidiata* form represents the attached habit of growth and the so-called *D. vesicularis*, the free specimens. Figures of the two extreme forms and of the intermediate, or central, type of shell are given on Plate (Figs. 27-29).

It is now necessary to decide if the Recent Australian form is the same as the species of the Paris Basin Tertiaries. None of the South Australian specimens corresponds closely with the type-figures of *D. vesicularis* (*Ann. Muséum*, viii., 1806, pl. lxii., fig. 7) or those of a topotype specimen, given by Cushman (1927, *Contr. Cushman Lab.*, iii. (2), pl. xxiv., figs. 1a-c). By the kindness of Mr. F. Chapman, I have a number of examples of *D. vesicularis* from the type locality at Grignon. These vary in much the same way as the Recent specimens, some having a rounded margin and others a sub-acute limbate border and flattened base. The differences between Recent Australian and fossil European specimens appear to consist mainly of the larger size of the test, the greater number of chambers to a whorl, and the better development of the astral flaps on the inferior surface in the former. Whether these differences are of specific value is doubtful, as, in tropical waters, *D. vesicularis* is represented

by examples which are inseparable from the smaller specimens from Grignon. Some have been figured by Heron-Allen and Earland in their work on the foraminifera of the Kerimba Archipelago (*Trans. Zool. Soc. London*, xx., 1915, p. 697, pl. lii., figs. 15-18). I have exactly similar specimens from Townsville, Queensland. The number of chambers, the size of the test, and the development of the deposit of shelly matter on the under surface all increase as temperate seas are reached. The Southern Australian form appears to be sufficiently distinct to justify its separation from *D. vesicularis* as a variety of that species, and may be known as var. *dimidiata* (Jones and Parker). It is typically of shallow water habitat, and, on the Australian coast, below the latitude of Sydney, it is by far the commonest representative of the genus. It is also common on some of the beaches near Auckland, N.Z.

The aperture of the present variety is normally an arched slit with a thickened rim, at the base of and near the umbilical margin of the last-formed chamber. In some cases, the lower portion of the centre of the apertural face is occupied by a number of very large perforations which often coalesce and so form supplementary apertures. Occasionally the whole of the coarsely-perforated area may be broken away, and we have then an aperture similar to that in the type-figure.

DISCORBIS VESICULARIS, var. ACERVULINOIDES, nov.

(Plate XXI., Figs. 30a-c.)

Description.—This variety may be distinguished by its conical test, the fewer chambers to the whorl, the coarse tubulation of the wall of the early chambers, and the comparatively slight development of the exogenous shell-growth on the inferior surface.

Diameter, 1 mm.; height, 0.88 mm.

Holotype (Parr Coll.) from *Posidonia* deposit, Gulf St. Vincent, South Australia, collected by D. J. Mahony, M.Sc. Other examples are from Stn. 9, and from the following localities, all from shore sands:—Minlacowie, South Aust.; Garden Island, and Geraldton, W.A. This variety is very common at the type locality.

Remarks.—Both megalospheric and microspheric forms are present, but except for the larger number of chambers in the latter, there is little difference between them. Some of the examples, particularly those which are not at all outspread in the last whorl, do not appear to be related to the preceding variety, but the relationship is made clear by the broader specimens, with their outer coil of well-inflated, coarsely-perforated segments.

DISCORBIS COLLINSI, sp. nov.

(Plate XXII., Figs. 33a-c.)

Description.—Test almost equally biconvex, the dorsal side somewhat more convex than the ventral, periphery rounded and lobulated; consisting of about two and a half whorls, with usually six chambers in the last-formed whorl, chambers well inflated; sutures oblique, distinct, depressed on the dorsal side, almost radial, slightly depressed and limbate, particularly at their inner ends, on the ventral side, which is slightly umbilicate; wall coarsely punctate; aperture a narrow slit at the base of the inner margin of the last-formed chamber, opening into the umbilical depression; colour usually white, but occasionally with the early portion a very pale brown.

Diameter, 0.44 mm.; height, 0.23 mm.

Holotype (Parr. Coll.) from shore sand, Port Fairy, Vie., collected by F. Chapman. It was common here. Other examples are from Stns. 6, 7, 9, 11, and from the Post-tertiary of a bore at Boneo, Vie.

Remarks.—The present species is quite unlike any other hitherto recorded from the Australian coast. *D. tuberculata* (Balkwill and Wright) has the same outline, but different apertural characters and ornament. I have pleasure in associating this species with the name of my friend, Mr. A. C. Collins, A.R.V.I.A., to whom I am indebted for the drawings illustrating this paper.

DISCORBIS DISPARILIS (Heron-Allen and Earland).

(Plate XXII., Figs. 32a-c.)

Discorbina disparilis Heron-Allen and Earland, 1922, *Brit. Ant. ("Terra Nova") Exped.*, 1910, *Nat. Hist. Rept., Foram.*, p. 205, pl. vii., figs. 20-22.

Stns. 8, 11.

Several examples. This species was described from two specimens dredged off New Zealand, 100 fms. In their notes on *D. disparilis*, Heron-Allen and Earland describe it as difficult to diagnose, owing to the obscuration of all of the earlier structure by the tuberculation of the superior surface, and by the fact that the inferior surface, which is plane, is thick-walled and opaque. The present examples agree closely in the shape of the test, the number and the arrangement of the chambers, but are thinner-shelled, and the superior surface is merely rough and irregularly thickened, not tuberculate, the chambers there being separated by raised, limbate sutures, which form a border to the shell. The dimensions of the largest Victorian specimen are—length, 0.46 mm.; breadth, 0.34 mm.; height, 0.13 mm. The length of the New Zealand specimens is given as 0.38–0.42 mm., and the maximum breadth as 0.30 mm. The outer margin of the last-formed chamber is usually rounded as in Heron-Allen and Earland's fig. 20, not angulate as in their fig. 21. The aperture is discorbine.

Sub-Family ROTALIINAE.

Genus **Rotalia** Lamarck, 1804.

ROTALIA PERLUCIDA Heron-Allen and Earland.

(Plate XXII., Figs. 35a-c.)

Rotalia perlucida Heron-Allen and Earland, 1913, *Proc. Roy. Irish Acad.*, xxxi., pt. 64, p. 139, pl. xiii., figs. 7-9; 1922, *Brit. Ant. ("Terra Nova") Exped.*, 1910, *Nat. Hist. Rept. Zool., Foram.*, p. 219.

Stn. 11.

Many good examples. This appears to be a weak form of *Rotalia beccarii* (Linné). The present specimens are finely perforate, but otherwise typical. The original examples were from the coast of Ireland, and the species has since been recorded from off the coast of New Zealand.

Family CASSIDULINIDAE.

Sub-Family CASSIDULININAE.

Genus **Cassidulinoides** Cushman, 1927.

CASSIDULINOIDES CHAPMANI Parr.

(Plate XXII., Figs. 36a-c, 37.)

Cassidulina parkeriana Heron-Allen and Earland (*non* Brady), 1924, *J.R.M.S.*, p. 146.

Cassidulinoides chapmani Parr, 1931, *Vic. Nat.*, xlviii., p. 99, Text-figs. a-c.

Stn. 7.

One typical example. This species has recently been described by the writer from the Miocene of Rocky Point, Torquay, Vic. The figures given represent the holotype and the Recent example here recorded. Other Recent specimens have been met with in a dredging from east of Tasmania, 1,320 fms.

Family ANOMALINIDAE.

Sub-Family ANOMALININAE.

Genus **Anomalina** d'Orbigny, 1826.

ANOMALINA NONIONOIDES, sp. nov.

(Plate XXII., Figs. 38a-c.)

Description.—Test almost equally biconvex, the thickness being about one-third of the diameter, periphery rounded, lobulated, the last whorl slightly evolute, umbilical region depressed; chambers numbering about ten to the coil in the adult, the later

ones inflated; sutures distinct, not limbate, gently curved, depressed in the later portion of the shell; wall coarsely perforate; aperture a narrow slit with a raised lip, at the peripheral margin, extending slightly to the dorsal side.

Diameter.—1 mm.; thickness, 0.33 mm.

Holotype (Parr Coll.) from shore sand, Narrabeen, N.S.W. There is one example from Torquay, Vic. (Stn. 7).

Remarks.—This species is moderately common in a number of shore sands from the vicinity of Sydney, N.S.W., and occurs on the Victorian coast. It does not appear to resemble any previously-described form closely. Of the species of *Anomalina* recorded from this region, Brady's *A. ammonoides* is not the same as Reuss's *Rosalina ammonoides*, from the Cretaceous of Europe, and the same remark applies to the Recent form recorded as *A. grosserugosa* (Gümbel).

Genus **Planulina** d'Orbigny, 1826.

PLANULINA BICONCAVA (Jones and Parker), var. PLANOCONCAVA
Chapman, Parr and Collins MS.

(Plate XXII., Figs. 34a-c.)

Stn. 6.

Two specimens. This variety is being described in a paper dealing with the foraminifera of the Oligocene (Balcombian) of the Port Phillip area. It differs from the typical form of *P. biconcava*, which is a common species on the southern coast of Australia, in having a more inequilateral test, with the inferior face flattened.

Family PLANORBULINIDAE.

Genus **Planorbulina** d'Orbigny, 1826.

PLANORBULINA RUBRA d'Orbigny, var.

(Plate XXII., Figs. 51a-c.)

Planorbulina rubra d'Orbigny, 1826, *Ann. Sci. Nat.* (Paris), vii., p. 280, No. 4 (*nomen nudum*). Fornasini, 1908, *Mem. Acc. Sci. Ist. Bologna*, [6], v., p. 44, pl. ii., fig. 3.

Gypsina rubra (d'Orb.): Heron-Allen and Earland, 1915, *Trans. Zool. Soc. London*, xx., p. 725, pl. liii., figs. 35-37.

Sporadotrema rubrum (d'Orb.): Hofker, 1927, *Siboga Exped., Mon.* iv., pt. 1, p. 21, pl. vii.; pl. viii., fig. 8.

Stn. 9.

There are about ten specimens which answer perfectly to the description given by Heron-Allen and Earland, except that the characteristic pale rose pink colour is absent. A similar white form is common in a shallow water dredging I have from Geraldton, W.A., so it is interesting to note that Heron-Allen

and Earland had the typical form of this species from an intermediate locality, viz., Fremantle, W.A., from shore sands. The pink form has also been recorded by them from Lord Howe Island. Hofker's records were from "Siboga" Station 19 and from the Island of Edam, near Batavia.

The plan of growth and the lipped apertures are very similar to those of *Planorbulina mediterraneensis* d'Orb., of which it seems to be merely a warm-water form characterised by its much larger size and exuberant shell-growth, as well as by its coloration. As Heron-Allen and Earland regard the pink coloration as a specific character, it is deemed advisable for the present to record the white form as *P. rubra*, var.

Explanation of the Plates.

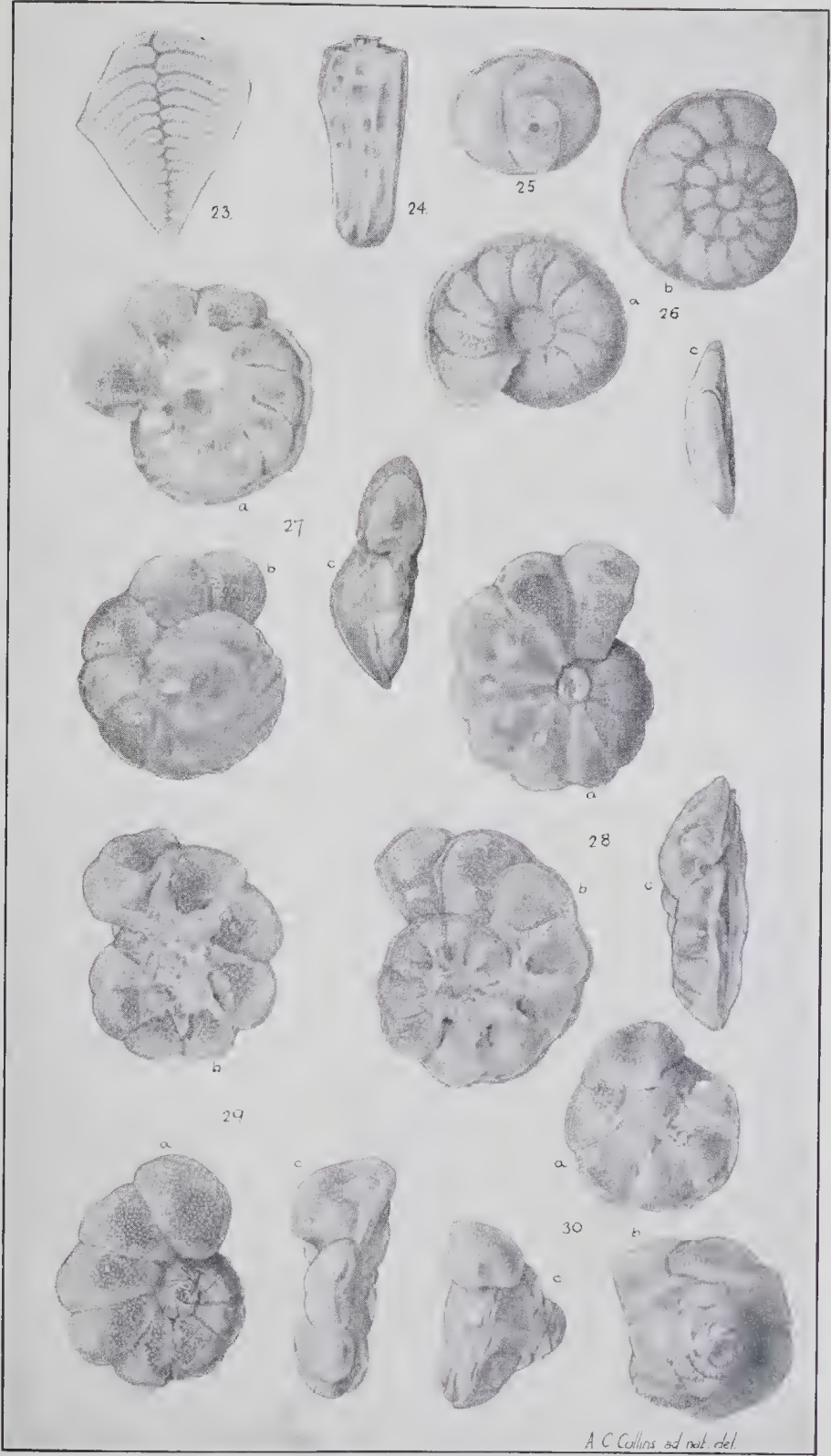
PLATE XXI.

- Fig. 23. *Bolivinella folium* (Parker and Jones). Point Lonsdale, Vic. (x 60.)
- Fig. 24. *Siphogenerina raphanus* (Parker and Jones). Point Lonsdale, Vic. (x 60.)
- Fig. 25. *Discorbis williamsoni* Chapman and Parr MS. Black Rock, Vic. (x 60.)
- Fig. 26a-c. *Discorbis margaritifera* (Heron-Allen and Earland). Point Lonsdale, Vic. (a), inferior aspect; (b), superior aspect; (c), edge view. (x 72.)
- Figs. 27a-c. *Discorbis vesicularis* (Lamarck), var. *dimidiata* (Jones and Parker). Intermediate type of shell. Point Lonsdale, Vic. (a), inferior aspect; (b), superior aspect; (c), edge view. (x 20.)
- Figs. 28a-c. *D. vesicularis*, var. *dimidiata* (J. and P.). Example of type form figured in Carpenter, Parker, and Jones's "Introduction to the Study of the Foraminifera." Glenelg, S.A. (a), superior aspect; (b), inferior aspect; (c) edge view. (x 20.)
- Figs. 29a-c. *D. vesicularis* var. *dimidiata* (J. and P.). Example of form figured by Carpenter, Parker, and Jones as *D. vesicularis*. Glenelg, S.A. (a), dorsal view; (b), inferior view; (c), edge view. (x 20.)
- Figs. 30a-c. *D. vesicularis*, var. *acervulinoides*, nov. Gulf St. Vincent, S.A. Holotype. (a), inferior view; (b), dorsal view; (c), side view. (x 25.)

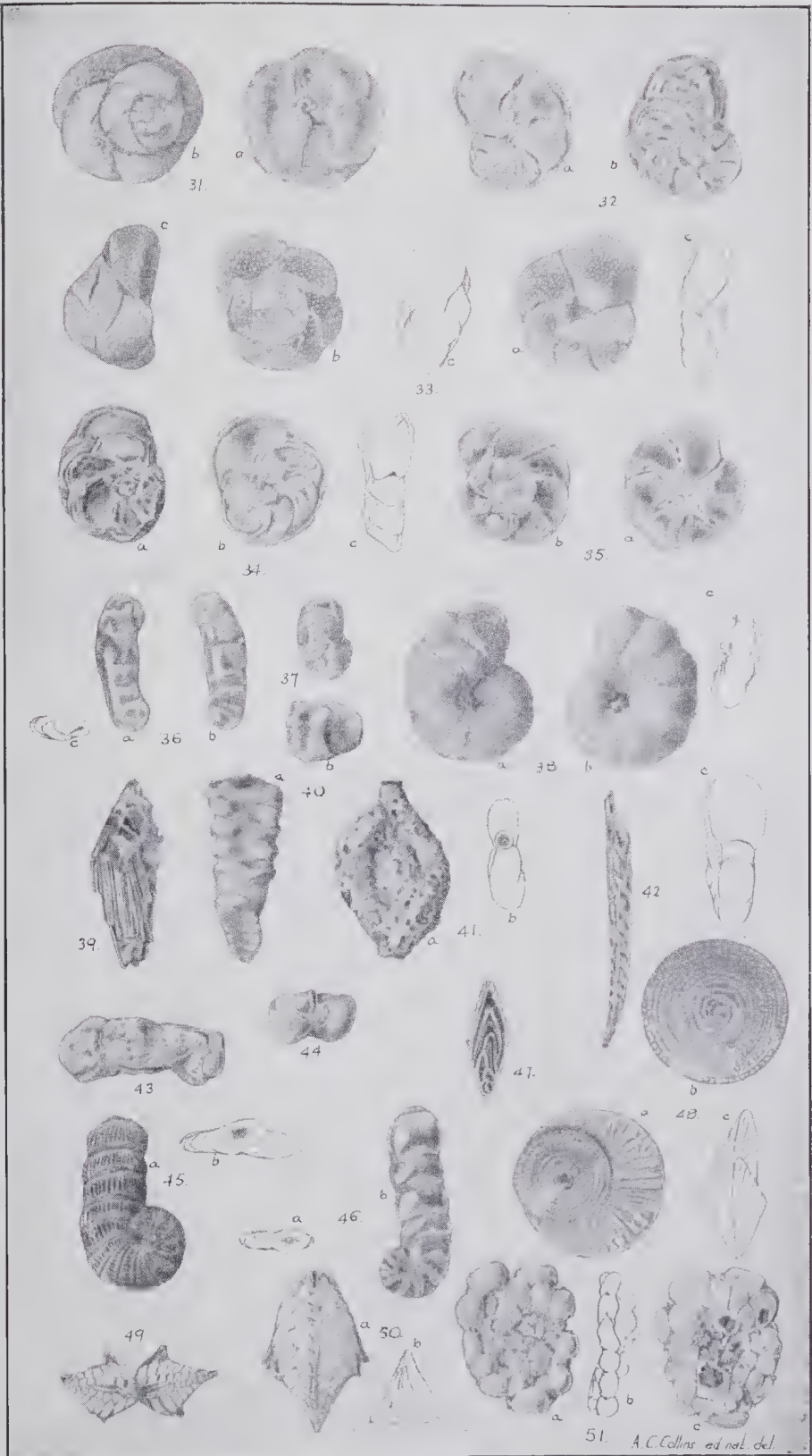
PLATE XXII.

- Figs. 31a-c. *Discorbis australis*, sp. nov. San Remo, Vic. Holotype. (a), inferior view; (b), dorsal view; (c), side view. (x 30.)
- Figs. 32a-c. *Discorbis disparilis* (Heron-Allen and Earland). Port Fairy, Vic. (a), inferior view; (b), dorsal view; (c), edge view. (x 48.)
- Figs. 33a-c. *Discorbis collinsi*, sp. nov. Port Fairy, Vic. Holotype. (a), ventral view; (b), dorsal view; (c), edge view. (x 48.)

- Figs. 34a-c. *Planulina biconcava* (Jones and Parker), var. *planoconcava* Chapman, Parr and Collins MS. Point Lonsdale, Vic. (a), dorsal view; (b), ventral view; (c), edge view. (x 48.)
- Figs. 35a-c. *Rotalia perlucida* Heron-Allen and Earland. Hardwicke Bay, S.A. (a), ventral view; (b), dorsal view; (c), edge view. (x 56.)
- Figs. 36a-c; 37. *Cassidulinoides chapmani* Parr. 36. Holotype from Miocene, Rocky Point, Torquay, Vic. (a, b), side views; (c), end view. 37. Recent specimen from shore sand, Torquay, Vic. (x 36.)
- Figs. 38a-c. *Anomalina nonionoides*, sp. nov. Holotype from shore sand, Narrabeen, N.S.W. (a), dorsal view; (b), ventral view; (c), edge view. (x 24.)
- Fig. 39. *Protconina spiculifera* Parr. Point Lonsdale, Vic. (x 18.)
- Figs. 40a, b. *Gaudryina hastata*, sp. nov. Port Fairy, Vic. Holotype. (a), side view; (b), end view. (x 15.)
- Fig. 41. *Spiroloculina* sp. aff. *arenaria* Brady. Westernport Bay, Vic. (a), side view; (b), end view. (x 15.)
- Fig. 42. *Vaginulina vertebralis*, sp. nov. Torquay, Vic. Holotype. (x 15.)
- Fig. 43. *Triloculina labiosa* d'Orb., var. *schauinslandi* (Rhumbler). Point Lonsdale, Vic. (x 15.)
- Fig. 44. *T. labiosa* d'Orb. Point Lonsdale, Vic. (x 15.)
- Figs. 45a, b. *Spirolina acicularis* (Batsch). Hardwicke Bay, S.A. Beaded form. (a), side view. (x 30.) (b), end view. (x 36.)
- Figs. 46a, b. *S. acicularis* (Batsch). Hardwicke Bay. Smooth form. (a), end view; (b), side view. (x 30.)
- Fig. 47. *Frondicularia advena* Cushman. Williamstown, Vic. (x 36.)
- Figs. 48a-c. *Annulopatulina annularis* (Parker and Jones). Hardwicke Bay, S.A. Two megalospheric specimens in the plastogamic condition. (a), (b), dorsal and ventral aspects; (c), edge view. (x 50.)
- Figs. 49, 50a, b. *Reussia armata*, sp. nov. Hardwicke Bay, S.A. 49, specimens in plastogamic condition; 50, holotype. (a), side view; (b), end view. (x 35.)
- Figs. 51a-c. *Planorbulina rubra* d'Orb., var. Glenelg, S.A. (a), dorsal view; (b), edge view; (c), ventral view. (x 20.)



A. C. Collins, sc. nat. del.



A.C. Collins *est not. del.*